

**REMARKS**

Claims 1-29 and 31-55 are pending in the application.

Claims 1, 9, 25, 31-33, and 48 have been amended. Support for the amendments to claims 1, 25, and 48 can be found, at least, in claim 13 as originally filed as well as on pages 33-35 of the specification. Claim 9 has been amended to provide correct antecedent basis in light of the amendments to claim 1. Claim 9 has not been narrowed by this amendment.

Claim 30 has been canceled. Claims 31-33 have been amended to depend on claim 25 instead of canceled claim 30. Claims 31-33 have not been narrowed by this amendment.

Claims 1-55 have been rejected.

**Rejection of Claims under 35 U.S.C. §112**

Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Office Action states that: "In claim 1, 'no more than six equations having no more than two branch decisions' does not clearly mention how many equations are used in the decoding and number of equations does not describe the features of the invention." Applicants respectfully traverse this rejection.

With respect to the first prong of the rejection, which asserts that claim 1 does not clearly mention how many equations are used in the decoding, Applicant notes that the amended claim clearly and definitely recites "generating a plurality of minimum-degree polynomials based on no more than six equations." Thus, the claim makes it clear that no more than six equations (i.e., six equations or less) are used to generate the minimum-degree polynomials. Accordingly, Applicant has clearly set forth a range for the number of equations that are used to generate the minimum-degree polynomials.

With respect to the second prong of the rejection, which asserts that the "number of equations does not describe the features of the invention," Applicant respectfully

disagrees. As amended, claim 1 recites: “extracting an error polynomial from the data signal, wherein the extracting comprises generating a plurality of minimum-degree polynomials based on no more than six equations having no more than two branch decisions.” By clearly setting forth the maximum number of equations and branch decisions used to generate the minimum-degree polynomials, the claim clearly describes one particular feature of the invention.

*Rejection of Claims under 35 U.S.C. §103*

Claims 1-6, 9-15, 17-18, 20-26, 30, 31, 32, 38, 39, 40, 42, 43, 44, 45, 55 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Oh et al (U.S. Pat. No. 5,583,499) (hereinafter referred to as “Oh”) in view of Wicker (Error Control Systems for Digital Communication and Storage, 1995, Prentice-Hall, Inc.) (hereinafter referred to as “Wicker”). Applicant respectfully traverses this rejection.

With respect to amended claim 1, the cited art fails to teach or suggest “extracting an error polynomial from the data signal, wherein the extracting comprises generating a plurality of minimum-degree polynomials based on no more than six equations having no more than two branch decisions.” As noted in the Office Action, Oh does “not explicitly teach the specific use of extracting an error polynomial from the data signal based on no more than six equations having no more than two branch decisions.” The Office Action relies on Wicker to teach this feature of the claims.

The Office Action cites pages 206-208 of Wicker as teaching “Peterson’s direct-solution decoding algorithm for the coefficients of the error locator polynomial.” This section of Wicker identifies how “Newton’s identities can be reduced to a system of  $t$  equations in  $t$  unknowns” (the  $t$  equations are shown as equations 9-7 on page 206). Peterson’s direct-solution decoding algorithm is presented as a technique for solving the  $t$  equations (equations 9-7) for the coefficients of the locator polynomial  $\Lambda(x)$  by expressing equations 9-7 in matrix form. Wilkes, p. 206. As explained on page 207, Peterson’s direct-solution decoding algorithm involves the following steps: (1) computing the syndromes for a received code word; (2) constructing the syndrome matrix (which expresses the  $t$  equations shown on page 206); (3) computing the determinate of

the syndrome matrix and, if the syndrome matrix is non-zero, proceeding to step 5; (4) constructing a new syndrome matrix by deleting the two rightmost columns and the two bottom rows from the old syndrome matrix, and proceeding back to step 3; and (5) solving the syndrome matrix for  $\Lambda$  to construct  $\Lambda(x)$ .

Peterson's direct-solution decoding algorithm does not teach or suggest extracting an error polynomial from the data signal, wherein the extracting comprises generating a plurality of minimum-degree polynomials based on no more than six equations having no more than two branch decisions. In particular, Peterson's algorithm does not generate any minimum-degree polynomials, nor does it suggest the generation of such minimum-degree polynomials. Instead, Peterson's algorithm generates the error locator equation by using matrix techniques to solve  $t$  equations for the coefficients of the error locator polynomial. Oh, both alone and in combination with Peterson, also fails to teach or suggest this feature of claim 1. For at least this reason, claim 1 is patentable over the cited art. Claims 2-6 and 9-12, which are dependent upon claim 1, are also patentable over the cited art for at least this reason. Amended claim 25 and its dependent claims 26, 30, 31, and 32 are patentable over the cited art for similar reasons.

With respect to claim 13, the cited art fails to teach or suggest "calculating a plurality of minimum-degree polynomials associated with the BCH code, using the Galois field multiply accumulators; and generating an error polynomial based on the minimum-degree polynomials."

The Office Action cites Oh as teaching generating a plurality of minimum-degree polynomials and generating an error polynomial based on the minimum-degree polynomials. Office Action, p. 5. However, the cited portions of Oh do not describe any minimum-degree polynomials that are used to generate an error polynomial. Instead, the cited portions of Oh describe:

"Using the syndrome values, coefficients of an error locator polynomial  $\sigma(X)$  are calculated." Oh, col. 1, lines 62-63.

"[T]he step of calculating the coefficients of the error locator polynomial [requires] a rather laborious computational task... In the Berlekamp-Massey algorithm, the error locator polynomial is obtained by an iterative

method. Specifically, the error locator polynomial is updated based on the syndrome values on each iteration. In order to calculate the coefficients of the error locator polynomial, various variables, e.g., correction terms, discrepancy, etc., are introduced. Oh, col. 2, lines 5-18.

Thus, Oh clearly does not teach or suggest generating error polynomial based on minimum-degree polynomials. As discussed above, the cited portions of Wilkes, both alone and in combination with Oh, also fail to teach or suggest generating an error polynomial based on minimum-degree polynomials. Accordingly, claim 13 is patentable over the cited art for at least this reason. Claims 14-15, 17-18, and 20-24, which depend from claim 13, are also patentable over the cited art for at least this reason.

With respect to claim 38, the cited art fails to teach or suggest “a state machine programmed to use said Galois field multiply accumulators to generate an error polynomial based on the following six equations:

$$(1) d_0 = S_1 ,$$

$$(2) d_1 = S_3 + S_1 S_2 ,$$

$$(3) \sigma^1(X) = 1 + S_1 X ,$$

$$(4) \text{ if } (d_1 = 0) \text{ then } \sigma^2(X) = \sigma^1(X)$$

$$\text{else if } (d_0 = 0) \text{ then } \sigma^2(X) = q_0 \sigma^1(X) + d_1 X^3$$

$$\text{else } \sigma^2(X) = q_0 \sigma^1(X) + d_1 X^2 ,$$

$$(5) d_2 = S_5 \sigma_0 + S_4 \sigma_1 + S_3 \sigma_2 + S_2 \sigma_3 , \text{ and}$$

$$(6) \text{ if } (d_2 = 0) \text{ then } \sigma^3(X) = \sigma^2(X)$$

$$\text{else } \sigma^3(X) = q_1 \sigma^1(X) + d_1 X^3 ,$$

where  $S_i$  are error syndromes,  $\sigma^i$  are minimum-degree polynomials,  $\sigma_i$  are four coefficients for  $\sigma^2(X)$ ,  $d_0$ - $d_2$  are correction factors,  $q_0$ - $q_1$  are additional correction factors,  $q_0$  is equal to  $d_0$  unless  $d_0$  is zero, when  $q_0$  is 1, and  $q_1$  is equal to  $d_1$  unless  $d_1$  is zero, when  $q_1 = q_0$ .”

The Office Action cites pages 207-208 of Wicker as teaching the use of the equations recited above. As described earlier, these pages describe Peterson's direct-solution decoding algorithm, which obtains an error locator equation by using matrix techniques to solve  $t$  equations for the coefficients of the error locator polynomial. The equations recited in claim 38 are clearly neither shown nor suggested in the cited portions of Wicker, nor are they shown or suggested in any of the other cited art. For at least this reason, claim 38 is patentable over the cited art. Dependent claims 39, 40, 42, 43, 44, 45 are also patentable over the cited art for at least the foregoing reason.

Furthermore with respect to the rejections under the combination of Oh and Wicker, there is no suggestion to combine the cited portions of Oh and Wicker. The Office Action states that the combination "would have been obvious... because one of ordinary skill in the art would have recognized that extracting an error polynomial from the data signal based on no more than six equations having no more than two branch decisions would provide the opportunity to reduce the number of circuit components and increase the decoding speed to determine the errors in the received data signal." Office Action, p. 3.

Applicant notes that neither reference explicitly states the desirability to obtain the error polynomial "based on no more than six equations having no more than two branch decisions" -- this language can only be found in Applicant's specification and claims. Furthermore, no art has been cited in support of the asserted suggestion to combine, nor do the references appear to suggest this position. In combination, these facts lead to the conclusion that the asserted suggestion to combine is impermissibly based in hindsight based on Applicant's claims. "To support the conclusion that the claimed combination is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed combination or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references... [S]implicity and hindsight are not the proper criteria for resolving the issue of obviousness." *Ex Parte Clapp*, 227 U.S.P.Q. 972, 973 (Bd. Pat. App. & Int'f 1985). "To imbue one of ordinary skill in the art with knowledge of the invention... when no prior art reference or

references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.” *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed.Cir.1983).

Additionally, the cited art teaches away from the combination. The Office Action cites portions of columns 1 and 2 of Oh as well as the portions of Wicker that describe Peterson’s algorithm in the rejection of claim 1. The cited columns of Oh explicitly describe how the Berlekamp-Massey algorithm, or a modified version of it, can be used to generate an error locator polynomial. On page 211, Wicker states that “Berlekamp’s algorithm is much more difficult to understand than Peterson’s approach, but results in a substantially more efficient implementation.” Given that Wicker explicitly states that Berlekamp’s algorithm is more efficient than Peterson’s, Wicker cannot be read as suggesting that the Berlekamp-Massey algorithm described in the cited portions of Oh be replaced with Peterson’s algorithm.

Claims 8, 16, 19, 27-29, 33, 34, 35, 36, and 37 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Oh and Wicker, as applied to claim 1, 13 above, and further in view of Stenerson (U.S. Pat. No. 4,597,083) (hereinafter referred to as “Stenerson”). Claim 41 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Oh and Wicker as applied to claim 38 above, and further in view of Wolf (U.S. Pat. No. 6,385,751 B1) (hereinafter referred to as “Wolf”). Claims 46-47 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Oh and Wicker as applied to claim 38 above, and further in view of Maki et al. (U.S. Pat. No. 4,873,688) (hereinafter referred to as “Maki”). These claims are patentable over the cited art for reasons similar to those provided above with respect to claims 1, 13, and 38.

Claims 48, 49, 50, 51, 52, and 53 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Alvarez et al. (US Pub. No. 2002/0165962 A1) (hereinafter referred to as “Alvarez”) in view of Kraft (U.S. Pat. No. 5,343,481) (hereinafter referred to as “Kraft”). Applicants respectfully traverse this rejection.

As amended, claim 48 recites: “decoding means including means for generating an error polynomial associated with a given one of the error-correction codes in no more than 12 clock cycles, wherein said decoding means uses a non-iterative algorithm to generate the error polynomial based on a plurality of minimum-degree polynomials.” Neither Alvarez nor Kraft, alone or in combination, teaches or suggests this feature of claim 48. In particular, Alvarez does not teach any non-iterative techniques for generating an error polynomial. Kraft teaches a circuit that “traverses a binary decision tree to find the polynomial coefficients.” Kraft, Abstract. In Kraft, three tree decision variables are calculated from the syndromes. These tree decision variables, along with the syndromes themselves, are used to traverse the binary decision tree in order to select one of eight possible error locator polynomials. Thus, Kraft obtains an error locator polynomial by using the syndromes and tree decision variables, calculated from the syndromes, to traverse a binary decision tree. The cited portions of Kraft, both alone and in combination with Alvarez, clearly neither teach nor suggest generating an error polynomial based on a plurality of minimum-degree polynomials. For at least this reason, claim 48 is patentable over the cited art. Dependent claims 49, 50, 51, 52, and 53 are also patentable over the cited art for at least this reason.

Claim 54 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Alvarez and Kraft as applied to claim 48 above, and further in view of Wicker. Applicants respectfully traverse this rejection for at least the reasons provided above with respect to claim 48.

**CONCLUSION**

In view of the amendments and remarks set forth herein, the application and the claims therein are believed to be in condition for allowance without any further examination and a notice to that effect is solicited. Nonetheless, should any issues remain that might be subject to resolution through a telephonic interview, the Examiner is invited to telephone the undersigned at 512-439-5087.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Mail Stop Amendment, COMMISSIONER FOR PATENTS, P. O. Box 1450, Alexandria, VA 22313-1450, on September 19, 2005.

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Date of Signature

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